Kinase signaling analysis of iPS cell reprogramming and differentiation

Grant Award Details

Kinase signaling analysis of iPS cell reprogramming and differentiation

Grant Type: Basic Biology II

Grant Number: RB2-01592

Project Objective: Use single cell analysis by mass cytometry to profile transitions that occur during iPS reprogramming and differentiation.

Investigator:

Name:	Garry Nolan
Institution:	Stanford University
Type:	PI

Human Stem Cell Use: iPS Cell

Award Value: $1,343,100

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3

View Report

Grant Application Details

Application Title: Kinase signaling analysis of iPS cell reprogramming and differentiation

Public Abstract:

Like embryonic stem (ES) cells, induced pluripotent stem (iPS) cells can differentiate into every cell type in the body, providing enormous potential for regenerative medicine. Unlike ES cells, the derivation of iPS cells is more straightforward technically, and can be performed on human adult cells. This potentially obviates the need for donated eggs or embryos, and permits the ability to generate patient-specific stem cells for disease research, drug development, and new cell-based therapies - generating great excitement in the scientific community as well as with the public.

iPS cells hold great promise for regenerative medicine, but the cellular signaling that controls their derivation and function remains poorly understood. We are developing methods to measure protein phosphorylation (the most common mechanism of cellular signaling) in iPS cells, and we will use the key signaling events we identify to improve the speed and efficiency of iPS derivation, as well as the safety and utility of iPS cells for regenerative medicine. In addition to improved iPS cell protocols that will benefit basic science and clinical therapy, the methods we develop to measure protein phosphorylation in will make a valuable diagnostic test for iPS and iPS-derived cells to determine their safety and functionality before use in patient-specific regenerative therapy.

Statement of Benefit to California:

Our proposal will benefit California in three important ways:

First, we will advance the field of stem cell biology as demanded by the people of California when they voted for Proposition 71, the California Stem Cell Research and Cures Initiative, on November 2, 2004 to establish The California Institute for Regenerative Medicine (CIRM). The mission of CIRM is to support and advance stem cell research and regenerative medicine under the highest ethical and medical standards for the discovery and development of cures, therapies, diagnostics and research technologies to relieve human suffering from chronic disease and injury. Our proposal will add new, essential knowledge concerning the function and molecular mechanisms of induced pluripotent stem (iPS) cells. The recent discovery of iPS cells has opened new frontiers in patient-specific regenerative therapy, the study of embryonic development and cellular differentiation, and the ability to create disease-specific cell lines for drug testing and the study of disease mechanism. Our study of the kinase signaling networks that control their derivation and function will add new, essential knowledge to the field of stem cell biology that will be published in a timely manner and readily available.

Second, the improved methods, protocols, and techniques we identify to control iPS cell derivation and function will be of great utility for the translation of iPS cells to the clinic, which will provide health benefits to all Californians. Our studies will identify new methods for iPS cell derivation that improve their safety for regenerative therapy by reducing their oncogenic potential. We will also develop new methods to control their differentiation into specified lineages or cell types for use in regenerative medicine. Additionally, the high-dimensional flow cytometry techniques we develop to analyze stem cell biology will be a useful quality control test to use on human stem and stem-derived cells before their use in regenerative therapy.

Third, our research will benefit California's robust biotechnology industry, not only by improving regenerative therapy, but also by identifying improved methods for the generation of disease-specific cell lines for drug testing and the study of disease mechanism. Strengthening the California biotechnology industry benefits all Californians, not only through improved drugs and therapies that benefit their health, but also by bringing more business to the state, increasing tax revenues, and providing much-needed employment opportunities.
